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IS 4511-2 (1986): Methods of Test for Styrene-butadiene Rubber (SBR) Latices, Part 2: Determination of Density [PCD 13: Rubber and Rubber Products]



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IS : 4511 ( Part 2 ) - 1986

*Indian Standard*

METHODS OF TEST FOR  
STYRENE-BUTADIENE RUBBER (SBR) LATICES

PART 2 DETERMINATION OF DENSITY  
SBRL : 6

( *First Revision* )

UDC 678.746.22 — 136.22 : 531.754



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*Indian Standard*METHODS OF TEST FOR  
STYRENE-BUTADIENE RUBBER (SBR) LATICESPART 2 DETERMINATION OF DENSITY  
SBRL : 6*( First Revision )*

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## *Indian Standard*

### METHODS OF TEST FOR STYRENE-BUTADIENE RUBBER (SBR) LATICES

#### PART 2 DETERMINATION OF DENSITY SBRL : 6

### *( First Revision )*

#### 0. FOREWORD

**0.1** This Indian Standard ( Part 2 ) ( First Revision ) was adopted by the Indian Standards Institution on 28 February 1986, after the draft finalized by the Rubber Sectional Committee had been approved by the Petroleum, Coal and Related Products Division Council.

**0.2** Test methods for rubber latex had been originally covered in the following Indian Standards:

*For Natural Rubber Latex*

IS : 3708 ( Part 1 )-1966\*

IS : 3708 ( Part 2 )-1968†

*For Styrene Butadiene Rubber Latex*

IS : 4511 ( Part 1 )-1967‡

Since some of the test methods covered in above standards were common, the concerned committee had decided some years ago to unify and publish a separate series of methods of test which would be applicable to all types of latices—natural as well as synthetic. Accordingly, the following six test methods had been covered under IS : 9316:

IS : 9316 Methods of test for rubber latex:

Part 1-1979 Determination of surface tension

Part 2-1979 Determination of viscosity

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\*Methods of test for natural rubber latex: Part 1 Dry rubber content, sludge content, density, total alkalinity, KOH-number, mechanical stability, volatile fatty acid number, pH, total nitrogen, total copper, total iron, total manganese and total ash.

†Methods of test for natural rubber latex, Part 2.

‡Methods of tests for styrene-butadiene rubber ( SBR ) latices: Part 1 Determination of dry polymer, pH, density residual styrene, bound styrene and soap content.

## **IS : 4511 ( Part 2 ) - 1986**

Part 3-1979 Determination of coagulum content

Part 4-1979 Determination of total solids content

Part 5-1979 Drawing of samples

Part 6-1982 Determination of pH

**0.2.1** As a result of further rethinking on the subject, it has now been decided to redesignate the test methods common to natural and synthetic rubber latices as RL series; test methods for natural rubber latex as NRL series and test methods for styrene-butadiene rubber latex as SBRL series. Consequently, test methods for rubber latex have been rationalized into the following three series:

- a) IS : 9316 Unified methods of test applicable to both natural and synthetic rubber latices — RL series;
- b) IS : 3708 Methods of test applicable to natural rubber latex — NRL series; and
- c) IS : 4511 Methods of test applicable to styrene-butadiene rubber latex — SBRL series.

**0.3** The existing Indian Standards under IS : 3708 ( Parts 1\* and 2† ), IS : 4511 ( Part 1‡ ) and IS : 9316 ( Parts 1 to 6 ) are being gradually replaced by separate standards under the above three series, designated by the appropriate NRL, SBRL or RL series, respectively.

**0.3.1** The methods covered under NRL: 13, NRL: 14 and NRL: 15 of IS : 3708 ( Part 1 )-1966 which are also under revision, have been proposed to be covered under the RL series in IS : 9316 ( *under revision* ).

**0.4** In order to facilitate cross-reference, it has been decided to retain the original discrete SBRL series numbers assigned to various test methods, in IS : 4511 ( Part 1 )-1967‡ in the revised parts of IS : 4511.

**0.4.1** For proper referencing of the existing test methods and the new methods under revision, a statement showing corresponding methods is given in Appendix A.

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\*Methods of test for natural rubber latex: Part 1 Dry rubber content, sludge content density, total alkalinity, KOH-number, mechanical stability, volatile fatty acid number, pH, total nitrogen, total copper, total iron, total manganese and total ash.

‡Methods of test for natural rubber latex, Part 2.

†Methods of tests for styrene butadiene rubber ( SBR ) latices: Part 1 Determination of dry polymer, pH, density, residual styrene, bound styrene and soap content.



**0.5** In reporting the result of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS : 2-1960\*.

## 1. SCOPE

**1.1** This standard ( Part 2 ) prescribes the procedure for determination of density of styrene-butadiene rubber latices by direct method.

## 2. OUTLINE OF THE METHOD

**2.1** This method gives density at the desired temperature and no conversions of the density need to be made to other temperatures. This method is, therefore, applicable to any type of latex and to any concentration of latex.

**2.2** The density of the latex is measured at  $27 \pm 2^\circ\text{C}$  by weighing a known amount of latex of known volume.

## 3. APPARATUS

**3.1 Analytical Balance** — capable of weighing to the nearest milligram.

**3.2 Thermometer** — capable of measuring laboratory temperatures to the nearest  $0.2^\circ\text{C}$ .

**3.3 Volumetric Flask** — 100-ml capacity flask with ground glass stopper.

## 4. PROCEDURE

**4.1 Calibration of Volumetric Flask** — Weigh a clean, dry and pretared and dry 100-ml volumetric flask. Fill the flask with water at laboratory temperature to a mark placed high up on the stem of the flask just below the glass stopper. This high mark on the stem diminishes the wall area inside the stem which is free from the adhering latex in the density determination. Weigh the flask plus water to the nearest mg. Record this mass and also the temperature of the water in the flask. For this temperature  $t$ , the volume of the flask to the mark is calculated from the following equation:

$$V = \frac{M_t - M}{d_t}$$

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\*Rules for rounding off numerical values ( revised ).

where

$V$  = volume in ml of the flask at laboratory temperature,

$M_t$  = mass of the flask plus the water at temperature  $t$  (  $t$  being the temperature in °C of water in the flask ),

$M$  = mass in g of the empty flask, and

$d_t$  = density of water in g/ml at temperature  $t$ .

**4.2** Weigh the clean, dry, pretared and calibrated flask to the nearest mg. Introduce latex into the flask through funnel to avoid sticking of latex to the joint areas, until the flask is approximately half full. Stopper the flask and weigh again to the nearest mg. Remove the stopper and add water to the calibrated mark. During the addition of this water swirl the flask at times, so as to free any bubbles which may be present in the latex. With the liquid level at the mark, stopper the flask and weigh again to the nearest mg. Mix the contents well and measure the temperature. The density measurement shall be reported at 27°C.

## 5. CALCULATION

**5.1** Calculate the density of the latex from the following equation:

$$D_t = \frac{M_1 - M}{V - \left[ \frac{M_2 - M_1}{d_t} \right]}$$

where

$D_t$  = density of the latex in g/ml at temperature  $t$  (  $t$  being the temperature in °C of the latex and water mixture in the volumetric flask );

$M_1$  = mass in g of the flask plus the latex;

$M$  = mass in g of the empty flask;

$V$  = volume in ml of the flask to the calibrated mark on the stem;

$M_2$  = mass in g of the flask containing latex and water up to the calibrated mark on the stem; and

$d_t$  = density of the distilled water in g/ml at temperature  $t$ .

# APPENDIX A

( Clause 0.4.1 )

**TABLE SHOWING CORRESPONDENCE OF THE VARIOUS METHODS OF TEST COVERED  
IN THE EXISTING IS : 9316 ( PARTS 1 TO 5 )-1979, IS : 9316 ( PART 6 )-1982, IS : 3708  
( PART 1 )-1966, IS : 3708 ( PART 2 )-1968, IS : 4511 ( PART 1 )-1967 WITH THE  
REVISION/PROPOSED REVISION OF IS : 9316, IS : 3708 AND IS : 4511**

EXISTING TEST METHODS			PROPOSED REVISION		
Test Method	IS No.	Part ( Series )	IS No.	Series	Remark
(1)	(2)	(3)	(4)	(5)	(6)
<i>RL Series</i>					
Determination of surface tension	IS : 9316-1979	Part 1	IS : 9316	Part 1 ( RL : 1 )	Under revision
Determination of viscosity	IS : 9316-1979	Part 2	IS : 9316	Part 2 ( RL : 2 )	
Determination of coagulum content	IS : 9316-1979	Part 3	IS : 9516	Part 3 ( RL : 3 )	
Determination of total solids content	IS : 9316-1979	Part 4	IS : 9316	Part 4 ( RL : 4 )	
Drawing of samples	IS : 9316-1979	Part 5	IS : 9316	Part 5 ( RL : 5 )	
Determination of pH	IS : 9316-1982	Part 6	IS : 9316	Part 6 ( RL : 6 )	
Determination of total copper	IS : 3708-1966	Part 1 ( NRL : 13 )	IS : 9316	Part 7 ( RL : 7 )	
Determination of total iron	IS : 3708-1966	Part 1 ( NRL : 14 )	IS : 9316	Part 8 ( RL : 8 )	
Determination of total manganese	IS : 3708-1966	Part 1 ( NRL : 15 )	IS : 9316	Part 9 ( RL : 9 )	
<i>NRL Series</i>					
Determination of dry rubber content	IS : 3708-1966	Part 1 ( NRL : 1 )	IS : 3708-1985 Part 1 ( NRL : 1 )		
Determination of sludge content	IS : 3708-1966	Part 1 ( NRL : 5 )	IS : 3708-1985 Part 2 ( NRL : 5 )		
Determination of density	IS : 3708-1966	Part 1 ( NRL : 6 )	IS : 3708-1985 Part 3 ( NRL : 6 )		
Determination of total alkalinity	IS : 3708-1966	Part 1 ( NRL : 7 )	IS : 3708-1985 Part 4 ( NRL : 7 )		

( Continued )

IS : 4511 ( Part 2 ) - 1986

EXISTING TEST METHODS			PROPOSED REVISION		
Test Method	IS No.	Part (Series)	IS No.	Series	Remark
(1)	(2)	(3)	(4)	(5)	(6)
Determination of KOH-number	IS : 3708-1966	Part 1 (NRL : 8)	IS : 3708-1985	Part 5 (NRL : 8)	
Determination of mechanical stability	IS : 3708-1966	Part 1 (NRL : 9)	IS : 3708-1985	Part 6 (NRL : 9)	
Determination of volatile fatty acid number	IS : 3708-1966	Part 1 (NRL : 10)	IS : 3708	Part 7 (NRL : 10)	
Determination of total nitrogen	IS : 3708-1966	Part 1 (NRL : 12)	IS : 3708	Part 8 (NRL : 12)	
Determination of total ash	IS : 3708-1966	Part 1 (NRL : 16)	IS : 3708	Part 9 (NRL : 16)	
Determination of boric acid	IS : 3708-1968	Part 2 (NRL : 17)	IS : 3708	Part 10 (NRL : 17)	
Determination of magnesium	IS : 3708-1968	Part 2 (NRS : 18)	IS : 3708	Part 11 (NRL : 18)	
<i>SBRL Series</i>					
Determination of dry polymer	IS : 4511-1967	Part 1 (SBRL : 1)	IS : 4511	Part 1 (SBRL : 1)	
Determination of density	IS : 4511-1967	Part 1 (SBRL : 6)	IS : 4511	Part 2 (SBRL : 6)	
Determination of residual styrene (volatile unsaturates)	IS : 4511-1967	Part 1 (SBRL : 8)	IS : 4511	Part 3 (SBRL : 8)	Under revision
Determination of bound styrene	IS : 4511-1967	Part 1 (SBRL : 9)	IS : 4511	Part 4 (SBRL : 9)	
Determination of soap content	IS : 4511-1967	Part 1 (SBRL : 10)	IS : 4511	Part 5 (SBRL : 10)	Under revision

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# INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

## Base Units

QUANTITY	UNIT	SYMBOL
Length	metre	m
Mass	kilogram	kg
Time	second	
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

## Supplementary Units

QUANTITY	UNIT	SYMBOL
Plane angle	radian	rad
Solid angle	steradian	sr

## Derived Units

QUANTITY	UNIT	SYMBOL	DEFINITION
Force	newton	N	$1 \text{ N} = 1 \text{ kg.m/s}^2$
Energy	joule	J	$1 \text{ J} = 1 \text{ N.m}$
Power	watt	W	$1 \text{ W} = 1 \text{ J/s}$
Flux	weber	Wb	$1 \text{ Wb} = 1 \text{ V.s}$
Flux density	tesla	T	$1 \text{ T} = 1 \text{ Wb/m}^2$
Frequency	hertz	Hz	$1 \text{ Hz} = 1 \text{ c/s (s}^{-1}\text{)}$
Electric conductance	siemens	S	$1 \text{ S} = 1 \text{ A/V}$
Electromotive force	volt	V	$1 \text{ V} = 1 \text{ W/A}$
Pressure, stress	pascal	Pa	$1 \text{ Pa} = 1 \text{ N/m}^2$



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